Remarks

In response to the Office Action mailed July 3, 2001, Applicant has amended the abstract, and corrected numbering and typographical errors in the drawings and specification. The claims have also been amended.

On prior art, the Examiner rejected the independent claims based upon the Maletsky and Reis patents as primary references taken together, and then rejected dependent claims based upon Maletsky and Reis in a three-way combination with Dodd et al. Applicant respectfully requests reconsideration of these rejections in view of the following remarks.

The communication schemes described by Maletsky and Reis are substantially similar, and share a common disadvantage. Specifically, in each scheme, tags respond to an interrogation during a time period, in a manner intended to spread the tag responses in that time period so as to avoid collisions between the responses.

As shown in Fig. 2 of Maletsky, tags are interrogated by a reader, which then listens during a response period for a error-free response. The tags, in response to the interrogation, compute a random time period, and then make a response at a random time during the response period. (See Maletsky, col. 4, lines 22-36.) The responses of tags may collide in the response period; the likelihood of such collisions is a function of the

length of the response period as compared to the number of tags in service. The period is made long enough to, at least most of the time, ensure that at least one tag can make an error free response during the response period. Once an error free response is received, then a command is sent to silence further responses, further communications are had with the tag that made the error-free response. Then, the process is repeated for all tags that have not yet made an error-free response. (See Maletsky, col. 6, lines 14-31.)

Reis describes a similar approach, in which tags respond to an interrogation, during time periods that are distributed over a listen period, which has a length selected based upon the number of tags in use. (See Reis, col. 17, lines 8-24.) Then communications are had with tags that did not experience collisions.

A notable disadvantage of this approach, which is articulated by Reis in the identified text in col. 17, is the inherent delays. Specifically, the longer the listen period, the more time is required to take inventory of tags. This not only slows recognition, but for battery operated tags, it shortens battery life, because longer communication times require more battery power.

The present invention avoids these difficulties of the Maletsky/Reis approach, by providing an interrogation scheme in

which an interrogation exchange is conducted efficiently. Furthermore, regardless of the number of tags responding during a given exchange, one and only one tag, in this case tag1, will always succeed in transmitting its identifier, collision notwithstanding.

This is achieved by a unique approach that is substantially different than Maletsky or Reis. Specifically, in this approach, interrogations of tags are made in a "bit-by-bit" manner, and each tag that has not previously responded, responds to the bit-by-bit interrogation, until such time as it does not receive an acknowledgment for one of its responses. A tag will abort its exchange when it fails to see an acknowledgment pulse in response to a bit-by-bit response. The master thus makes a bit-by-bit interrogation of all tags simultaneously. After interrogating a bit, the master acknowledges only those responses having one of the two possible values "1" or "0" for the bit. The master's failure to make an acknowledgment for one of these values, indicates to tags having the unacknowledged bit value, to discontinue transmissions. This allows the master to initiate and continue an exchange with an ever-decreasing group of tags, systematically eliminating tags from the exchange until, at the end of the bit-by-bit interrogation, one and only one tag has been identified.

The Examiner will note that the claims recite that the master communicates with the slaves in a "bit-by-bit" manner, and the slave will continue transmission of bit-by-bit information only during receipt of acknowledgments of each bit from the master.

In contrast to this claimed scheme, the Maletsky and Reis patents describe a scheme in which tags do not make a bit-by-bit communication with the master, nor do the tags discontinue transmission of bit-by-bit information when there is no acknowledgment of each bit from the master. Rather, in Maletsky and Reis, tags attempt to transmit an entire identifier to the master, and the entire identifier is acknowledged, or not, by the master. The consequence is that a long period of time is required, simply to identify one of the tags to be the target of future communications, whereas the present invention combines the process of identifying a tag for communications, with the process of interrogating that tag. The present invention thus avoids the substantial delays and battery life reductions that are disadvantages of the Maletsky and Reis approaches, as specifically recognized by Reis in the text quoted above.

The Examiner's third reference is the Dodd et al. patent (hereafter, Dodd). The Dodd patent describes a scheme that is different from Maletsky and Reis, and also different from and suffering disadvantages relative to the claimed invention.

In the Dodd patent, the interrogator transmits a partial identifier, and then determines the responses to that partial identifier. Specifically, as explained in the example in Dodd in col. 8, lines 7-61, the interrogation process is a tree-search, which in a first step seeks to determine whether there are transponders with a 1 or a 0 in their first bit. The next step seeks to determine whether, among the transponders with a 1 in their first bit, there are transponders with both a 1 and 0 in their second bit. The next step seeks to determine whether, among the transponders with the values 10 in their first two bits, there are transponders with a 1 and a 0 in their third bit.

Notably, again, the Dodd approach requires parsing of a complete search tree, involving multiple transmissions and responses interrogating transponders, to identify a single transponder. This implies substantial delays to identify individual tags, and the resulting performance and battery life disadvantages. These delays are an inherent consequence of the Dodd scheme, in which identifying one tag requires generating individual requests and responses, formulated by the interrogator to identify groups and sub-groups of tags, and the tags subject to those requests produce a single response rather than a bit-by-bit series of responses.

In contrast, in the present invention, the master does not need to formulate individual requests and responses for

groups and subgroups to find a single tag, and thus can save the time associated with making multiple requests for a single tag. Rather, the master simply interrogates the bits of all tags in a bit-by-bit manner, until all bits have been interrogated. Each tags produces a series of responses to this bit-by-bit interrogation, so long as an acknowledgment is made by the master to each bit response. Again, a consequence is that each bit-by-bit sequence will always identify one tag, but only one tag. This has clear advantage over Dodd, in which a multi-step tree search process must be performed for each tag separately.

With regard to Dodd, again, the claim language noted above clearly brings forth these distinctions. That language states that the master communicates with the slaves in a "bit-by-bit" manner, and each slave will continue transmission of bit-by-bit information only during receipt of acknowledgments of each bit from the master. Neither is true of Dodd.

In view of the foregoing distinctions of the cited references from the claimed invention, and the apparent advantages of the claimed invention, Applicant submits that all claims are patentable and requests early transmission of a Notice of Allowability.

A new power of attorney directing correspondence to the undersigned law firm is included with the communication. The Examiner is requested to confirm the correspondence address for

this application has been corrected prior to the next action in this application.

A three month petition for extension of time, and check for the appropriate fee, is attached to the transmittal of this communication. If, however, the fee is missing or insufficient, or if any other extension or fee is necessary to accompany this communication, please consider this paper a petition for such an extension of time, and/or apply the appropriate fee to Deposit Account 23-3000.

Respectfully submitted,

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Version With Markings to Show Changes Made

In the abstract:

In a [A] system of communicating between a master communication device and a plurality of slave communication devices [is disclosed], [whereby] the master determines if any of the plurality of slave devices exist within a defined geographic area and, if so sends a bit-by-bit command for the slaves to identify themselves via a unique binary identification number. To avoid collision when the slaves respond, the slaves respond to the master's command within a predetermined period of a time window providing the ID bit by bit. Responses are acknowledged by the master such that only one slave is able to respond with its compute full ID after a bit-by-bit command from the master.

In the specification:

Page 9, lines 5-10:

At block [20] 21, the master transmits an "are you there" message which is detected by any tag which is within the field of coverage.

At block 22, if there is no response to the "are-you-there" message, then the master knows there are no tags in the field. The master will then wait a short period of time before starting the process over at block [20] 21. If there is a response from any tag, execution continues at block 24.

Page 11, line 17 to Page 12, line 7:

Tag2 will abort its exchange with the master when it fails to see an acknowledgment pulse in response to its "0" pulse 38 in the bit 22 window. The early acknowledgment pulse in the bit 22 window indicates that the master has detected another tag, in this case the transmitted pulse 40 from tag1 in the time period 26 of bit 22 window [22]. The master then does not send tag2 the acknowledgment that it expects in response to the pulse 38 that it sent. When tag2 does not receive an acknowledgment within a predetermined time after sending pulse 38, tag2 enters an idle state and will send no more responses to the master during the current "bit-by-bit" exchange. This allows tag1 to continue its exchange with the master and complete its identification process, as indicated by the transmitted pulse 40 from tag1 during the bit 21 window. Regardless of the number of tags responding during a given exchange after a bit-by-bit command, only one tag, in this case tag1, will succeed in transmitting its unique 24-bit binary identification number to the master after 24 time windows. The present invention also ensures that one tag will actually succeed during every exchange after a bit-by-bit command, collision notwithstanding.

In the drawings:

Fig. 2 has been revised to change the number 20 to the number 21 on the block for the step MASTER SENDS OUT "ARE-YOU-THERE" MESSAGE.

In the claims:

1. A system of communicating between a master communication device and at least one slave communication device for determining if said at least one slave is within a [particular geographic area] field of coverage and for identifying said slave, the system comprising:

a master communication device having transmitting and receiving means, said master establishing a field of coverage and initiating [a request to determine if there are any] communications with slave communication devices within said field of coverage;

at least one slave communication device having transmitting and receiving means and a [unique] binary identification number, said at least one slave [receiving said request and sending a response to] communicating with said master to [indicate that said at least one slave is within said field of coverage] provide said binary identification number; and

said master [, after receiving said response from said at least one slave,] sending a command to said at least one slave for said at least one slave to provide said [unique] binary identification number, and

said at least one slave receiving said command and providing information [to said master, said information being] representative of bits of said unique binary identification number to said master in a bit-by-bit manner, said slave continuing transmission of said information only during receipt of acknowledgments of each bit from said master.

10. In a communication system having a master communication device and at least one slave communication device, a method for determining if said at least one slave is within a [particular geographic area] field of coverage and for identifying said at least one slave, said method comprising the steps of:

establishing a field of coverage;

determining if said at least one slave is within said field of coverage, said at least one slave having a [unique] binary identification number;

sending a command requesting said [unique] binary identification number of said at least one slave; and

identifying said at least one slave via transmission of information representative of bits of said unique binary identification number to said master in a bit-by-bit manner, said

slave continuing transmission of said information only during receipt of acknowledgments of each bit from said master.

19. A radio frequency (RF) communication system for determining if at least one object is within a [particular geographic area] field of coverage and for identifying said object, said system comprising:

a RF communication device having a transmitter and a receiver, said device generating a RF transmission to said field of coverage [defining said geographic area] and transmitting a request signal to determine if there are any objects within said field of coverage;

a tag capable of being affixed to said at least one object, said tag having a transmitter, a receiver and a [unique] binary identification number, and said tag receiving said request signal and transmitting a response signal to said communication device to [indicate that said object is within said field of coverage] provide said binary identification number to said device in a bit-by-bit manner, continuing transmission of information only during receipt of acknowledgments of each bit from said device; and

said device [, after receiving said response signal from said tag, transmitting a command to said tag for said tag to send said unique binary identification number, and said tag] receiving [said command and transmitting timed pulses to said device] transmissions that are representative of bits of said unique binary identification number and acknowledging said transmissions in a bit-by-bit manner.

20. A method for communicating in a radio frequency (RF) communication system for determining if at least one object is within a [particular geographic area] field of coverage and for identifying said at least one object, said method comprising the steps of;

generating a RF transmission to said field of coverage [defining said geographic area] and transmitting a request to determine if there are any objects within said field of coverage;

affixing a tag to at least one object, said tag receiving said request and transmitting a response to [indicate that said at least one object is within said field of coverage] provide said binary identification number in a bit-by-bit manner, continuing transmission of information only during receipt of acknowledgments of each bit; and

[transmitting a command to said tag for said tag to provide a unique binary identification number, and said tag] receiving [said command and transmitting information] transmissions representative of bits of said unique binary identification

number and acknowledging said transmissions in a bit-by-bit manner.

FIG. 1

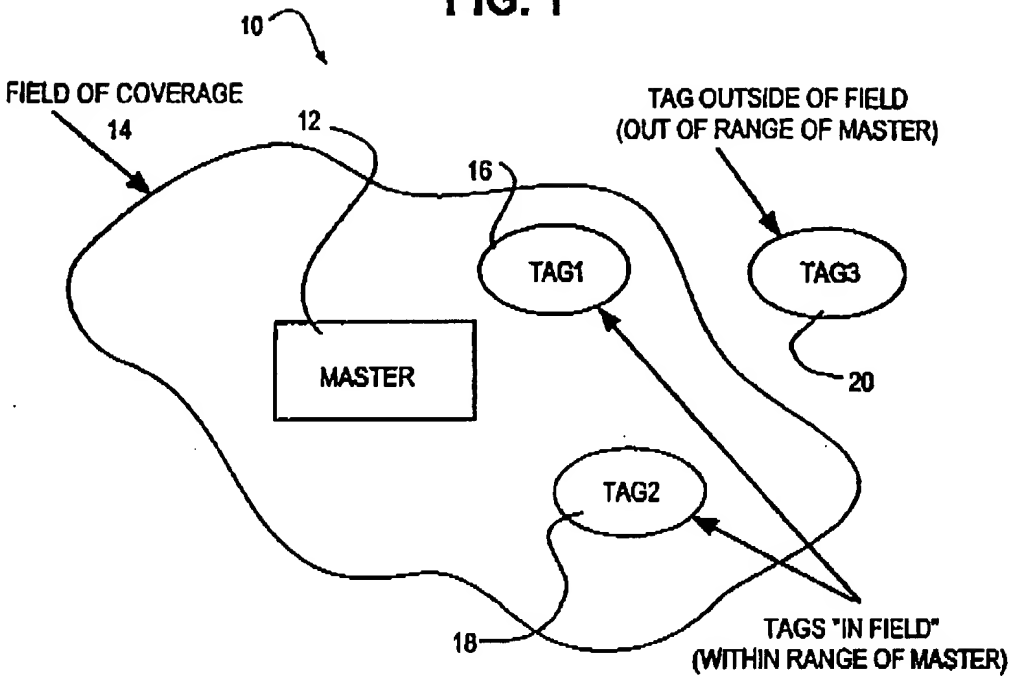

FIG. 2